DOCUMENT RESUME

ED 235 366 CE 037 283

AUTHOR Spignesi, B.
TITLE Front-End Types. Automotive Mechanics. Steering & Suspension. Instructor's Guide [and] Student Guide.
INSTITUTION State Fair Community Coll., Sedalia, Mo.
REPORT NO AM-83-270
PUB DATE Feb 83
NOTE 14p.; For related documents, see CE 037 282-287. Audiocassette and 35mm slide presentation are not available with this document.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052) -- Guides - Classroom Use - Materials (For Learner) (051)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Auto Mechanics; Behavioral Objectives; Classroom Techniques; *Equipment Maintenance; Guidelines; Individualized Instruction; Instructional Materials; *Job Skills; Learning Modules; *Mechanical Skills; Postsecondary Education; Secondary Education; *Trade and Industrial Education
IDENTIFIERS Automobiles; Front End Types (Automotive); *Steering (Automotive); *Suspension Systems (Automotive)

ABSTRACT

This instructional package, one in a series of individualized instructional units on automotive steering and suspension, consists of a student guide and an instructor guide dealing with automobile front-end types. Covered in the module are three common types of passenger car front suspension systems and their major components as well as two types of steering linkages and their major components. The student guide contains an introduction, a list of procedures for completing the module, and an information sheet. Included in the instructor guide are an introduction, performance objectives, a list of references, suggested instructional methods, a student posttest, answers to the posttest, and an instructional script. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED235366

INSTRUCTOR'S GUIDE

PROGRAM: AUTOMOTIVE MECHANICS **UNIT TITLE:** STEERING & SUSPENSION

MODULE TITLE: FRONT-END TYPES **MODULE NO.** AM-83-270

INTRODUCTION:

A thorough knowledge of front-end types and the function of the front-end components is essential to the student mechanic. Accurate diagnosis, repair, and alignment are the results of study, knowledge, and experience.

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it.
- Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

PERFORMANCE OBJECTIVES:

After completing this module, the student should be able to:

1. Identify three common types of passenger car front suspension systems.
2. Name the major components of these three types of front ends.
3. Identify the two types of steering linkages covered in this module.
4. Name the major components of these two steering systems.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Learning Groups Designed For:

- __x__ Adult
- _____ Special Needs
- __X__ Secondary
- __X__ Post Secondary

Written By:

B. Spignesi 2-83

THE MEDIA CENTER State Fair Community College
1900 Clarendon Road
Sedalia MO 65301
(816) 826-7100

Specializing in the development of Mediated Instructional Materials

CE037283

TEACHING/LEARNING RESOURCES:

1	Student Packet		Videocassette
1	Instructor's Guide, Key, and Script		Film Loop
1	35 mm Slide Presentation	1	Audiocassette
	Filmstrip		

REFERENCES:

1. Factory service manuals.
2. Stockel, Martin W., Stockel, Martin T., Auto Mechanics Fundamentals, The Goodheart-Willcox Co., Inc. 1982.
3. Crouse, William H., Anglin, Donald L., Automotive Chassis and Body, McGraw-Hill Book Co., 1976.

INSTRUCTIONAL METHODS SUGGESTED:

This packet is designed for individualized instruction and adaptable for open entry/exit programs, however, these materials can be used to supplement traditional instruction methods. Tests can be used for pretesting for advanced placement of students who are already competent in this area. Demonstrations by the instructor are recommended to enhance student learning.

STUDENT EVALUATION
KEY
FRONT-END TYPES

NOTE: Before taking this test as a posttest you must have:

a. Read and studied the supportive material in this module.

b. Watched the slide/tape presentation AM-83-270, Front-End Types.

INSTRUCTIONS: Match the component purpose with the name of the component.

F	1. Spindle	A.	Links spindle to relay rod
J	2. Strut rod	B.	Links ball joint to frame
B	3. Control arm	C.	Dampens spring oscillation
I	4. Ball joint	D.	Helps prevent vehicle sway
C	5. Shock absorber	E.	Connects pittman arm to idler arm
A	6. Tie rod	F.	Supports the rotating wheel
H	7. Idler arm	G.	Unit consisting of the spring, shock, ball joint and spindle
D	8. Stabilizer	H.	Supports one end of relay rod
G	9. McPherson strut	I.	Pivot point for steering knuckle
E	10. Relay rod	J.	Prevents fore and aft movement of control arm

11. The steering linkage utilizing a relay rod, idler arm, and pittman arm is referred to as a Parallelogram type steering linkage.

12. The steering system using a toothed shaft that meshes with a gear from the steering wheel shaft is referred to as rack and pinion steering.

13. Two types of front springs are the coil spring and torsion bar spring.

14. The shock absorber controls spring oscillation.

15. To help prevent lean or sway on turns, most cars are equipped with stabilizer bars on the front end.

AM-83-270 STEERING AND SUSPENSION, FRONT-END TYPES - SCRIPT

1. This is a presentation of The Media Center, State Fair Community College, Sedalia, Missouri.

2. AM-83-270 STEERING AND SUSPENSION, FRONT-END TYPES

3. There are probably as many variations of front-end design as there are makes of cars on the road.

4. Each automobile manufacturer designs the front-end to suit the special requirements of the particular vehicle.

5. Even though there are many manufacturers of cars, and a number of variations in front end design, there are only three basic types of front ends presently used on passenger cars, and this lesson will discuss these three.

6. After completing this lesson you should be able to: (1) Identify three common types of passenger car front suspension.

7. (2) Name the major components of these three types of front ends.

8. (3) Identify the two types of steering linkages covered in this module.

9. (4) Name the major components of these two steering systems.

10. The three basic types of suspension presently used on passenger cars are: (1) The control arm type, with the spring attached to the lower control arm,

11. (2) The control arm type, with the spring mounted on the upper control arm, and

12. (3) The McPherson Strut type.

13. The front end has a difficult job to do. It must not only move up and down on bumps and curves, but it must also allow the wheels to pivot laterally for steering.

14. Notice here that although side "B" has raised to go over a bump, the frame and side "A" remain level. This is referred to as independent front suspension.

15. For a number of years, the most common type of front end has been the long arm/short arm suspension with the spring on the lower control arm.

16. In this earlier version of independent suspension, both control arms were the same length. Notice the tire-wearing side slip of this design.

17. This is the improved version now in use. Since the short arm swings on a smaller arc than the long arm when the car moves over bumps, the tire thread contacting the road remains in about the same place eliminating most of the side slip.

18. All upper control arms of this type are generally of the "A" or "wishbone" frame type.

19. The lower control arm may also be of the wishbone type, with two separate pivot points where it attaches to the frame,

20. or of the beam type with one point of attachment to the frame.

21. To prevent any forward or backward movement of the beam type lower control arm, a strut rod is connected from the arm to the frame.

22. The front end of the strut rod is mounted in rubber bushings to allow for the normal up and down movement of the control arm.

23. The coil spring supports the weight of the vehicle and flexes on bumps. It is attached to the lower control arm and socket on the frame.

24. The torsion bar is a different type of spring used on some vehicles. It attaches to the lower control arm at one end and a socket in a frame cross member at the other. The torsion bar's resistance to being twisted provides the necessary spring action.

25. The steering knuckle, the part on which the wheel is mounted, is attached to the upper and lower control arms with ball joints for turning the wheels.

26. The lower ball joint, with the spring pushing one direction and the wheel pushing the other, is the load carrying connection between the vehicle.

27. The upper ball joint supports the top of the wheel and acts as a pivot point for steering. It is not subject to the loads of the lower ball joint and is referred to as the follower ball joint.

28. The spindle, extending from the steering knuckle, supports the wheel on tapered roller bearings.

29. The shock absorbers, attached in the same manner as the springs, dampen the bouncing action of the springs.

30. A variation on the long arm/short arm type discussed earlier is the front end with the spring and shock absorber on the upper control arm. The components of this front end are similar to the front end utilizing the lower control arm for spring action.

31. However, since the vehicle weight is now supported by the upper control arm through the upper ball joint, the upper ball joint becomes the lead carrying joint and the lower joint becomes the follower.

32. The McPherson Strut-type front end, previously used only on import cars, is now being used on many small- and intermediate-sized domestic cars.

33. The major component of this system is the strut, a shock absorber surrounded by a coil spring.

34. The steering knuckle is attached to the strut so that when the wheels are turned the entire strut turns.

35. The strut pivots on a ball joint at the lower end

36. and a bearing at the upper end.

37. A lower control arm running from the frame to the ball joint prevents fore-and-aft and side-to-side movement of the strut.

38. The stabilizer bar is another important component of the front end and is found on most cars.

39. It acts on both lower control arms on turns and in crosswinds to help prevent vehicle sway by keeping both lower control arms level.

40. The steering linkage

41. is the connection between the steering wheel

42. and the front wheels, relaying the movement of the steering wheel to the front wheels.

43. The most common type of steering linkage for many years has been the parallelogram design.

44. With this design, the center link connects the Pittman arm and the idler arm. The tie rods connect the center link to the arms of the steering knuckle.

45. Another type of steering linkage being used more and more, especially on today's smaller cars, is the rack-and-pinion steering system.

46. The major features of this system are the rack, a toothed shaft attached at either end to the steering arms with adjustable tie rod ends, and a pinion gear that meshes with the rack teeth. When the pinion is turned by the steering wheel, the rack moves turning the wheels.

47. Obviously, every variation of front end design cannot be covered in this lesson, so additional individual study would be helpful.

48. Let's summarize the material covered in this lesson.

49. There are three common types of passenger car front ends: the control arm type, with the spring on the lower control arm; the control arm type with the spring on the upper control arm; and the McPherson Strut type.

50. The major components of the control arm types are: the upper arm, the lower arm, the spring or torsion bar, strut rod, frame, ball joints, knuckle, stabilizer, and the shock absorber.

51. The major components of the McPherson Strut system are: the strut, which includes the spring and shock absorber; the steering knuckle which attaches to the strut; the lower ball joint; the upper bearing; a control arm running from the frame to the ball joint; and the stabilizer.

52. The two types of steering linkages currently in production are: the parallelogram type and the rack-and-pinion type.

53. The major components of the parallelogram type are: the idler arm, the Pittman arm, the center link, the tie rods, and the steering arms of the knuckles.

54. The major components of the rack-and-pinion system are: the rack, with tie rod ends which attach to the arms of the knuckles; and a pinion gear which is attached to the steering wheel shaft.

55. You should continue your individual studies in front-end systems by reading trade journals, textbooks, and shop manuals.

56. (CREDITS)

57. (DISCLAIMER)

58. (REWIND)

STUDENT EVALUATION

FRONT-END TYPES

NOTE: Before taking this test as a posttest you must have:

a. Read and studied the supportive material in this module.

b. Watched the slide/tape presentation AM-83-270, Front-End Types.

INSTRUCTIONS: Match the component purpose with the name of the component.

___1.	Spindle	A.	Links spindle to relay rod
___2.	Strut rod	B.	Links ball joint to frame
___3.	Control arm	C.	Dampens spring oscillation
___4.	Ball joint	D.	Helps prevent vehicle sway
___5.	Shock absorber	E.	Connects pittman arm to idler arm
___6.	Tie rod	F.	Supports the rotating wheel
___7.	Idler arm	G.	Unit consisting of the spring, shock, ball joint and spindle
___8.	Stabilizer	H.	Supports one end of relay rod
___9.	McPherson strut	I.	Pivot point for steering knuckle
__10.	Relay rod	J.	Prevents fore and aft movement of control arm

11. The steering linkage utilizing a relay rod, idler arm, and pittman arm is referred to as a _____ type steering linkage.

12. The steering system using a toothed shaft that meshes with a gear from the steering wheel shaft is referred to as _____ steering.

13. Two types of front springs are the _____ spring and _____ spring.

14. The shock absorber controls spring _____.

15. To help prevent lean or sway on turns, most cars are equipped with _____ on the front end.

STUDENT GUIDE

PROGRAM: Automotive Mechanics **UNIT TITLE:** Steering & Suspension

MODULE TITLE: Front-End Types **MODULE NO.** AM-83-270

PERFORMANCE OBJECTIVES:

After completing this module, you should be able to:

1. Identify three common types of passenger car front suspension systems.
2. Name the major components of these three types of front ends.
3. Identify the two types of steering linkages covered in this module.
4. Name the major components of these two steering systems.

THE MEDIA CENTER State Fair Community College
1900 Clarendon Road
Sedalia MO 65301
(816) 826-7100

Specializing in the development of Mediated Instructional Materials

INTRODUCTION

A thorough knowledge of front-end types and the function of the front-end components is essential to the student mechanic. Accurate diagnosis, repair, and alignment are the results of study, knowledge, and experience.

PROCEDURES

1. Read the objectives and introduction to this module.
2. If you feel you can pass a pretest covering the objectives with at least 90 percent accuracy, ask your instructor for the pretest.
3. If you do not take the pretest or do not meet the minimum requirements on the pretest, continue with the next procedure.
4. Study the information sheets which are a part of this learning packet.
5. Observe and listen to slide/tape presentation AM-83-270, Front-End Types.
6. For additional information refer to the following resources:
   a. Factory service manual.
   b. Stockel, Martin W., Stockel, Martin T., Auto Mechanics Fundamentals, The Goodheart-Willcox Co., Inc., 1982.
   c. Crouse, William H., Anglin, Donald L., Automotive Chassis and Body, McGraw-Hill Book Co., 1976.
7. Review the objectives to be certain you understand what you are expected to have learned. Performance of these objectives will be evaluated on the posttest.
8. Ask your instructor for a test over this module. You are required to achieve at least 90 percent accuracy on this test before preceeding to the next module.
9. When you pass the test with 90 percent or better accuracy, proceed to the next module.

INFORMATION SHEET

The early front ends consisted of nothing more than a steel beam extended across the front of the car with steering knuckles at either end, pivoting on steel pins. Any up and down movement of one side was transmitted directly to the car.

In the evolution of the automobile, the change to independent front suspension made possible many improvements in vehicle design, ride, and handling. For the first time the engine could be placed forward, over the front wheels and set lower in the frame without interference with the front axle.

For a number of years the long arm, short arm type of front end has been used on domestic cars. It consisted of arms attached to pivot points, upper and lower on either side of the vehicle body or frame. This type of suspension is still in use on many cars today. The steering knuckle, the part that supports the tire and wheel, and which they pivot about for steering, is attached to the arms using ball joints.

The ball joint, similar in construction to the ball and socket on your ball point pen, provides for the necessary turning and up and

down movement of the front wheels, at the same time preventing any side to side or fore and aft movement. The ball socket is generally fastened to the control arm and the ball with a threaded shaft attached, is fastened to the steering knuckle.

The springs, either coiled, or straight torsion bars, support the weight of the vehicle and dampen road shock such as bumps and holes. This prevents most of the shock from being transferred to the vehicle. The springs can be either fastened at one end to the lower control arm and the other end to the frame or fastened in a like manner to the upper control arm. The shock absorbers, also fastened to a control arm and the frame, dampen the spring oscillations thus preventing continuous bouncing after the bump.

A stabilizer bar running from one lower control arm to the other and fastened to the frame in the center, transfers any upward movement of one lower control arm to the other helping to limit any lean or sway of the car on turns.

The steering linkage, usually of the parallelogram or rack and pinion type, transfers the motion of turning the steering wheel to

turning of the front wheels.

Another type of front end, the McPherson strut is being used more frequently on the smaller cars now being produced. Using less moving parts, the strut front end is much lighter in weight. The main component of the McPherson strut front end is the strut, consisting of the steering knuckle, ball joint, spring and shock absorber all in one unit. A control arm fastened to the lower end of the strut and the frame, prevents any fore and aft or side to side movement.

In summary: It is important that you study your textbook during the completion of this module, don't depend on your instructor or the slide/tape presentation to tell you all you need to know.